Research Proposal of the Thesis Entitled

Clinical outcome of minimally invasive procedures for internal derangement of TMJ

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By

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INTRODUCTION

The disc displacement of temporomandibular joint (TMJ) is one of the common disorders of TMJ affecting about 20-40% of world population also called internal derangement (ID)**.** Painful temporomandibular joint not only affects daily routine and personality of the patients but leads to poor personal image[1]. Hey in 1814 used internal derangement as a general orthopaedic term for a localised mechanical fault in a joint but later on the term internal derangement got more used specifically for the displacement of the TMJ disc. The symptoms of patients with internal derangement range from discomfort to pain in the joint or pre-auricular area, clicking or grating sound, a limited motion of jaw, maladaptive jaw function, the abnormal deviation of jaw while opening, and closed or open locking of jaw or sometimes with tinnitus of ear[2].

Internal derangements of TMJ result in progressive displacement of the articular disc or disc gets anchored to cranial component of joint in a sizeable number of patients with the disorder. The abnormal forward positioning of the disc during opening, which reduces on closing to its original positions labelled as anterior disc displacement with reduction[3]. The advanced cases are characterised by non-reducing disc and damage to the

disc or surrounding structures of joint.

Normally the superior head of lateral pterygoid muscle stabilizes the disc, however it becomes ineffective in disc displacement and as a compensatory mechanism, lower head of lateral pterygoid takes over, and this leads to abnormal muscle activity during mouth movements [4,5]. The abnormal muscle activities of joint lead to guarding and which further limits the movement of joint.

The aberrant and abnormal forward positioning of the articular disc, which does not recapitulate or reduce when the mouth is closed is called as disc displacement without reduction .Larger forces per unit area of teeth compared to the articular surfaces of TMJ leads to a greater degree of wear and tear, which is pre-curser to joint damage, which may progress to osteoarthritis in later life (Scully, 2008)[6].

In actuality the internal derangement of TMJ means altered disc condyle relationship which can be in the form of disc displacement with or without reduction, or anchored disc phenomenon or degeneration in the disc or condlylar component. There are many clinical/radiological classifications for internal derangement of TMJ, however commonly Wilkie's classification is followed for ease.

Wilkes classification of internal derangement of TMJ is as follows[7]:-

Stage I Early

Clinically: Clicking which is painless the mouth opening is normal.

Radiographically: There is mild disc displacement with early reduction and disc shape/formis normal.

Stage II Early/Intermediate

Clinically there is painful clicking occasionally with locking which is intermittent and radio graphically there is mild to moderate disc displacement which reduces late with mild deformity of disc.

Stage III Intermediate

Clinically there is joint tenderness with limited opening of mouth with pain occurring frequently and radio graphically the disc is displaced and non-reducing with deformity.

Stage IV Intermediate/Late

Clinically there is chronic pain with limited opening of mouth, radio graphically there is severe displacement without reduction and degenerative osseous changes.

Stage V Late

Clinically there is variable joint pain with crepitations and radio graphically there is non-reducing disc with perforation of disc attachment or degenerative osseous changes in disc.

The internal derangement of TMJ is a functional disorder and has been studied and investigated extensively because of its unique nature. The main modality of treatment till 1975, was removal of the disc or relocating it by surgical means[8].

Ohnisini advocated and introduced lavage for breaking down of adhesions and draining the inflammatory mediators, resulting in subsequent diminishing of pain and increase of the mouth opening with the use of arthroscope. The lavage has demonstrated clinically successful results with minimal invasion of joint but arthoscopy needs lot of learning curve and the arthoscopes are very much expensive and we in India are still importing this expensive equipment and hence every hospital or clinic cannot afford to install arthoscope. The arthoscopes not only have diagnostic value but therapeutic value also. However, joint damage and infection, the otitis media for ear, the nerve and muscle injury in the area, perforation of tympanic membrane or middle cranial fossa are complications of arthoscopy in inexperienced or less skilful hands[9,10,11].

The arthoscopioc lavage can be replaced by arthocentesis with equal

results and with minimal instrumentation in the form of 18 or 19 gauge needles or cannules which are easily available in market in every corner of India.

The arthrocentesis is a conservative approach for TMJ lavage, with fewer complications, and lower cost and not much armamentarium is required[12,13]. The arthocentesis doesn't need a well established hospital setup like in tertiary care hospitals.

The insertions points to approach the superior joint space of the TMJ for needles have been extensively studied and are easily drawn by any clinician well versed with the anatomy of TMJ as the surface landmarks are easily discernible and repeatable[14,15].

The arthocentesis procedure carries the risk of extra-articular injection into neighbouring structures like ear or brain by perforating glenoid fossa, and at times multiple punctures for approaching the joint for the right place which can result in post-operative discomfort and there is probability for facial nerve injury and hematoma formation.[16-19] Various surgical splints and devices can be made available with computer assisted simulation which brings virtual plan into theatre[20, 21,]. However, the use of computer-guided surgical planning for proper positioning of the needles which can be repetitive, has not been studied so widely in the

literature.

The use of predetermined points for needle insertion by the fabrication of pre- auricular splint by the use of computer assisted design for exact location of the superior joint anatomy for needle insertion for arthocentesis can avoid multiple punctures which are otherwise very common in conventional arthocentesis. The present study bridges the gap between arthoscopy and arthocentesis by the use of surgical guide /splint manufactured by 3D virtual simulation technology after obtaining MRI/CT of the joint which are investigations of the routine in the diagnosis of internal derangement of TMJ.

AIM

The study compares and emulates the effectiveness of computer guided arthocentesis with conventional arthocentesis for the treatment of stage 3 and stage 4 of internal derangement of TMJ.

Objectives

1. Is arthocentesis a viable option for improving joint function and effective treatment for internal derangement in stage 3 and 4 of disease?
2. Is computer assisted arthocentesis superior to conventional arthocentesis?

Hypothesis

The comparative efficacy of computer guided arthocentesis and conventional arthocentesis in the treatment of internal derangement of TMJ will show significant difference in the improvement of mouth opening, reduction of pain and TMJ function.

Null Hypothesis

The comparative efficacy of computer guided arthocentesis and conventional arthocentesis in the treatment of internal derangement of TMJ will show no significant difference in the improvement of mouth opening , reduction of pain and TMJ function.

REVIEW OF LITERATURE

Ingervall B, Mohlin B, Thailander B in (1980)[22] in their study on 389 subjects in Swedish population found that about 60% had mandibular dysfunction in their study of TMJ dysfunction due to single tooth contact or cuspal interferences .

Sharma et al in (2014)[23] studied effect of PRP in the degenerative articular disorders of TMJ and they concluded that the symptoms of pain,dysfunction and reduced mouth opening showed a considerable and significant improvement from baseline after PRP theraphy at 2 and 6 monthly period folloup of treatement.after PRP and arthocentesis..

Nitzen et al in (1991); in their study of arthocentesis on patients with

internal derangement concluded that arthocentesis is less expensive procedure with minimal morbidity and better results for the relief of pain and improvement of mouth with only disadvantage of multiple needle punctures or occasional facial nerve injury or fluid extravastion in surrounding tissues which needs little or no intervention.

Honda and Bjornland in (2006)[24]utilised CBCT imaging in proper needle insetion in the superior joint space and demonstrated successful depth insertion in 50 out of 52 patients.

Matsumoto et al., (2011)[25] in their comparative study on CBCT guided needle insertion into joint space compared to convetional needle insertion observed a success rate of 97% as compared to 82% in 76 studied cases.

Fritz et al., (2009)[26] demonstrated MRI as golden investigation for TMJ arthoscopy ,however indicated about its cumbersome nature for limited room space for operating despite MRI being superior in delineating the structures.

Research Methodology

Place of Study**:** Noora Hospital Srinagar Kashmir

Study Design**:** Interventional study.

Study Population**:** Patients between the age group 16–45 years.

Duration of Study**:** 6 months

Sample size ***n*** **=** **[**DEFF*Np(1-p)]/ [($d^2/Z^2_{1-\alpha/2}$*(N-1)+p*(1-p)]

Sample Size for Frequency in a Population

Population size (for finite population correction factor or fpc) (*N*):	50
Hypothesized % frequency of outcome factor in the population (*p*):	50%+/-5
Confidence limits as % of 100 (absolute +/- %)(*d*):	5%
Design effect (for cluster surveys-*DEFF*):	1

This prospective interventional study will be done on patients who will report to the Department of Maxillofacial Surgery or will be referred with internal derangement of temporomandibular joint (Wilkes type II,III,IV).The size of sample will be 100 .Each patient will be labelled in internal derangement after clinically co- relating patient symptoms with MRI findings.

Inclusion criteria for patients:

- Patients already diagnosed with internal derangement of temporomandibular joint (wilkes II, III, IV).
- Patients who have negative serology for arthritis

- Age group 16-45 years
- No sex predilection
- Patient who are willing and thus giving consent.
- Only such patients will be included in study who had previous conservative TMJ management like drugs, splint therapy/tens/laser or botox without complete resolution of TMJ symptoms

Exclusion criteria for patients:

- History of earlier TMJ procedures will be excluded.
- Patients who have systemic disease that contraindicates the surgical procedure.
- Patient who are not willing for surgery and not giving consent.
- Patients with ankylosing spondylitis or rheumatoid arthritis
- Patients with any lesion in joint.
- Patients with active ear or joint infection

The objective of this study are to analyse*:-*

- Pain intensity (0-10 VAS scale)
- Maximal inter-incisal opening
- TMJ sounds
- Lateral movements of TMJ.

The pre-operative diagnostic aids for TMJ will be through proper history taking and examination OPG, TMJ views, CT (axial) and MRI.

Both hard and soft tissue windows of CTin motion will be analysed.

The retrieved DICOM files of the CT scans will be imported in a specialized DICOM (Digital Imaging and Communication in medicine) viewer, the planning for the patient- specific guides, will be performed by the software (MIMICS medical 19.0 Materialise. Leuven, Belgium).Ethical clearance will be given by Institutional ethical committee.

Material and Methods:

- Disposable closed set for blood collection
- Computer guided patient specific splint
- 2o gauze-syringes
- 2% lignocaine with1:80000 adrenaline
- Probe
- Mouth mirror
- Tweezer
- Divider and metallic scale.
- Stethoscope

The arthocentesis will be performed under strict aseptic conditions, the patients will be given choice whether they will opt for splint guided arthocentesis or conventional arthocentesis.

The landmarks for the needle insertion will be Holmund-Helsing line

which is drawn from midtragus to the lateral canthus of eye .The 10mm in-front of midtragus and 2mm below it will correspond to point A and 20 mm on this line and 10mm below this will correspond to point B for conventional arthocentesis, for splint guided needle insertion the splint will be used for the needle insertion which will have two holes for needle insertion.

The arthocentesis will be performed with ringer lactate, 400 ml of volume will be used for irrigation. Follow-up will be performed with a clinical check list after 1 week, at 1 month, 3 months, and at 6 months after procedure. Pain will be measured on VAS scale, mouth opening by millimetre scale, lateral movements by millimetre scale and TMJ joint sounds by stethoscope.

Arthrocentesis will be repeated until symptoms will not relieved after every five weeks.

Operative technique

- A proper consent will be obtained after explaining in local language and the patients will be prepared for the surgery in the standard operative manner.
- The procedure will be carried in local anaesthesia or sedation and standard nerveblocks will be used for anesthesia.

- The patient specific guide will be applied and adapted; either unilaterally orbilaterally, to fit the patient's face.
- Two 18 or 19 gauge needles will be inserted to the planned depth.
- Patency and appropriate location of the needle will be checked by inserting few dropsof ringer lactate and waiting for outflow.
- The Ringers lactate solution will be injected through the inlet needle afterconfirmation of needle insertion and about 400ml of volume will be used.
- The lower jaw will be manipulated by opening, closing, and in lateral and protrusivemovements.
- After removal of the needles, the pressure dressing is placed for 24 hours.

In conventional arthocentesis point A and B as described will be used for theprocedure, rest of the procedure will be same.

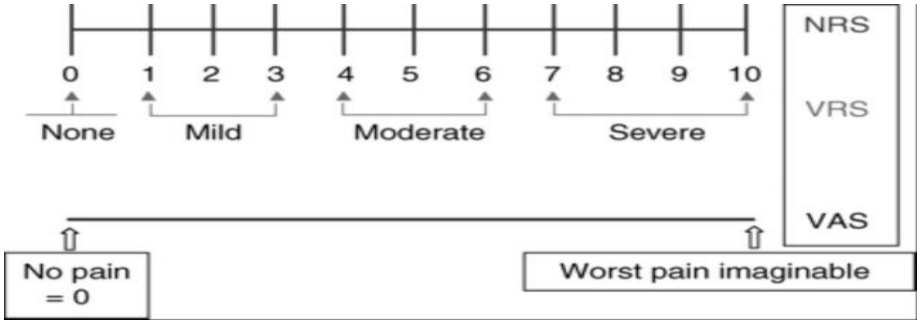
PARAMETERS

1. Pain analysis (by visual analogue scale).
2. Mouth opening (by clinical analysis).
3. Lateral movements (by clinical analysis)
4. TMJ sound (by clinical analysis)

1. Pain Analysis:

It will be assessed by pain analogue scale (visual analogue scale)

pre operatively and post operatively during opening and closing mouth.



2. Mouth opening:

The mean value and range of maximum mouth opening of 50.3 mm±6.26mm for males and 49.9±6.74mm for females. These values are significant with the width of three fingers.

To distinguish normal and restricted mouth opening the patients will be asked to align their fingers vertically between upper and lower central incisors.

Assessment the mouth opening will be done by comparing pre and post mouthopening widely.

The pair of dividers will be used by placing its tips on incisal edges of upper and lower incisors and distance will be measured in mm.

It will also be correlated with the reduction status.

3. Lateral movements

Lateral excursions are measured by comparing the potential differences in dental midline of upper and lower jaws after maximum lateral movements have been attained. Opening to lateral movement ratio is 4:1 within normal limits. The right and left lateral movements will be noted at each follow up interval. It will be correlated with reduction status.

4. TMJ Sound

Presence of TMJ sounds will be assessed by palpatory method and auscultation of temporomandibular joint by stethoscope at different follow up.

Training and calibration:

All the patients will be followed by one investigator and data will be entered by the same investigator in data sheet.

Statistical analysis

Data interpretation and comparative analyses of results will then be done by appropriate software. All the generated data will be analyzed using standard statistical methods. A p value <0.05 will be considered significant and the logistic correlation analysis will be used to determine the pain analysis, functional outcome, lateral movements, TMJ sound. The chi-

square test, student paired and unpaired t test other descriptive and inferential will be utilized in the statiscal analysis of the data.

REFERENCES

1. Carvajal WA, Laskin DM. Long-term evaluation of arthrocentesis for the treatment of internal derangements of the temporomandibular joint. J Oral Maxillofac Surg 2000;58:852-5; discussion 856-7.

2. Dolwick MF. Intra-articular disc displacement. Part I: its questionable role in temporomandibular joint pathology. J Oral Maxillofac Surg 1995;53:1069-72.

3. Alpaslan GH, Alpaslan C. Efficacy of temporomandibular joint arthrocentesis with and without injection of hyaluronic acid in treatment of internal derangements. J Oral Maxillofac Surg 2001;59:613–8.

4. Truelove EL, Sommers EE, LeResche L, Dworkin SF, Von Korff M. Clinical diagnostic criteria for TMD. New classification permits multiple diagnoses. J Am Dent Assoc 1992;123:47-54.

5. McCain JP, Hossameldin RH. Arthroscopic arthroplasty of the temporomandibular joint. In: Haggerty CJ, Laughlin RM, eds. Atlas of operative oral and maxillofacial surgery. Ames: WileyI.

6. Intra-articular platelet-rich plasma injection for the treatment of temporomandibular disorders and a comparison with arthrocentesis*Mustafa Hancı a, Mehtap Karamese b, *, Zekeriya Tosun b, Tahsin Murad Aktan c,Selcuk Duman c, Nedim Savaci

7. Fonseca: Text Book of Oral and Maxillofacial Surgery (3rd edition).

8. Laskin DM. Arthroscopy versus Arthrocentesis for Treating Internal Derangement of temporomandible. Oral Maxillofac Surg Clin NorthAm. 2018 Aug; 30(3):325-328.

9. Zhang S, Yang C, Cai X, Liu X, Huang D, Xie Q, Haddad MS, Chen Z. Prevention and treatment for the rare complications of arthroscopic surgery in the temporomandibular joint. J Oral Maxillofac Surg. 2011 Nov; 69(11):e347-53.

10. Tsuyama M, Kondoh T, Seto K, Fukuda J. Complications of temporomandibular joint arthroscopy: a retrospective analysis of 301 lysis and lavage procedures performed using the triangulation technique. J Oral Maxillofac Surg. 2000 May; 58(5):500-5.

11. Nitzan DW, Dolwick MF, Martinez GA. Temporomandibular joint arthrocentesis: a simplified treatment for severe, limited mouth opening. J Oral Maxillofac Surg.1991 Nov; 49(11):1163-7.

12. Senturk MF, Cambazoglu M. A new classification for temporomandibular joint arthrocentesis techniques. Int J Oral Maxillofacial Surg. 2015 Mar; 44(3):417-8.

13. Tozoglu S, Al-Belasy FA, Dolwick MF. A review of techniques of lysis and lavage of the TMJ. Br J Oral Maxillofac Surg. 2011 Jun; 49(4):302-9.

14. Senturk MF, Yazici T, Gulsen U. Techniques and modifications for TMJ arthrocentesis: A literature review. Cranio. 2018 Sep;36(5):332-340

15. Alkan A, Etoz OA. A new anatomical landmark to simplify temporomandibular joint arthrocentesis. Br J Oral Maxillofac Surg. 2010 Jun; 48(4):310-1.

16. Dayisoylu EH, Cifci E, Uckan S. Ultrasound-guided arthrocentesis of the temporomandibular joint. Br J Oral Maxillofac Surg. 2013 Oct;51(7):667-8.

17. Bell RB. Computer planning and intraoperative navigation in craniomaxillofacial surgery Clin North Am. 2010 Feb; 22(1):135-56.

18. Abdel-Moniem Barakat A, Abou-ElFetouh A, Hakam MM, El-Hawary H, Abdel- Ghany KM. Clinical and radiographic evaluation of a computer-generated guiding device in bilateral sagittal split

osteotomies. J Craniomaxillofac Surg. 2014 Jul; 42(5):e195-203.

19. Santos GS, Sousa RC, Gomes JB, Maciel J, Sonoda CK, Garcia IR Jr, de Melo WM. Arthrocentesis procedure: using this therapeutic maneuver for TMJ closed lock management. J Craniofac Surg. 2013 Jul; 24(4):1347-9.

20. Kristensen KD, Stroustrup P, Alstergren P, Küseler A, Herlin T, Pedersen TK. Signs and symptoms after temporomandibular joint washing and cannula placement assessed by cone-beam computerized tomography. Acta Odontol Scand. 2015 Aug; 73(6):454-60.

21. Sakamoto I, Yoda T, Tsukahara H, Imai H, Enomoto S. Comparison of the effectiveness of arthrocentesis in acute and chronic closed lock: analysis of clinical and arthroscopic findings. Cranio. 2000 Oct; 18(4):264-71.

22. Ingervall B, Mohlin B, Thilander B: Prevalence of symptoms of functional disturbances of the masticatory system in Swedish men, *J Oral Rehabil* 7:185-197, 1980.

23. S M Sharma, Dhruvit Thakur. The CLincal Efficacy of Autologous Concentrated Platelets In Treatment of TMJ disorders- A Pilot Study. Nitte University Journal of Health Sciences;2014; NUJHS 4, No.3.

24. Honda K, Bjørnland T: Image-guided puncture technique for the superior temporomandibular joint space: value of cone beam computed tomography (CBCT). Oral Surg Oral Med Oral Pathol Oral Radiol Endod. 2006 Sept 102(3):281-6,

25. Matsumoto K, Bjørnland T, Kai Y, Honda M, Yonehara Y,Honda K: An image-guided technique for puncture of the superior temporomandibular joint cavity: clinical comparison with the conventional puncture technique. Oral Surg Oral Med Oral Pathol Oral Radiol Endod. 2011 May; 111(5):641.

26. Fritz J, Thomas C, Tzaribachev N, Horger MS, Claussen CD, Lewin JS,Pereira PL: MRI-guided injection procedures of the temporomandibular joints in children and adults: technique, accuracy, and safety. AJR Am J Roentgenol. 2009, Oct; 193(4).

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